UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 2
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Date: September 17, 2012

Subject: National Remedy Review Board Recommendations -
Raritan Bay Slag Superfund Site

From: John S. Frisco, Manager
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To: Amy R. Legare, Chair
National Remedy Review Board

This is in response to your memorandum, dated July 5, 2012, which provided the advisory recommendations of the National Remedy Review Board (NRRB, or the "Board") in connection with its review of the proposed remedial action for the Raritan Bay Slag Superfund site, located in the Townships of Old Bridge and Sayreville, New Jersey.

Let me first express the Region's appreciation to the Board for both its thorough review and thoughtful comments on the proposed remedial action for the site which was discussed during the March 14, 2012 web conference. As a result of the Board recommendations, the Region re-evaluated site conditions and modified elements of its previous remedial approach. The Region believes that the modified approach represents a more cost-effective remedy for the site. Our specific responses to the Board's advisory recommendations are provided below. For convenience purposes, each recommendation is presented in the order identified in your memorandum followed by our response.

1. Institutional Controls

The package presented to the Board did not provide detailed information on the types of institutional controls (ICs) that will be needed under CERCLA to ensure protectiveness of human health with regard to all of the affected media, as well as for fishing and clamming. Nonetheless, the Board notes that there are already bay-wide advisories. The Board encourages the Region to work with the State to consider and address any current and potential future exposures that may occur. The Board recommends that the Region's decision documents provide detailed information on use restrictions and areas requiring controls for both the implementation phase of the remedial action and after completion, if need be. Also, it would be helpful for the decision documents to identify the IC implementation measures and specify the entity(ies) responsible for implementing them.

Response: *In the Feasibility Study (FS) under Section 4.3.1.1 Institutional Controls, a detailed description of information can be found on the types of institutional controls that will be*

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required. Institutional Controls are a Common Element applicable to all alternatives except Alternative 2. The Region believes that the level of detail currently depicted in the FS addresses the objectives of ICs to: (1) prevent exposure to contaminant concentrations associated with unacceptable risk, (2) control future development that could result in an increased risk of exposure, and (3) restrict installation of drinking water wells within the contaminated area.

The Region believes that once a remedy is selected, a detailed IC implementation strategy can be elaborated and refined during design. This will include a review of existing bay-wide advisories and evaluating the need for additional ICs with input from the stakeholders. Entities responsible to implement and enforce the ICs will also be identified in the design. That said, the Region will be providing additional discussion of the IC issue in both the proposed plan and Record of Decision (ROD) to ensure that the public fully understands the role of ICs in the remedy.

2. Human Health and Ecological Risk

In the materials presented to the Board, the Region stated that the ecological risk assessment portion of the remedial investigation was a screening level ecological risk assessment, versus a full baseline ecological risk assessment (BERA), with the addition of several focused ecological risk characterizations. In addition, the Region indicated that a substantial portion of the remedy will be driven by ecological risks. While the Board recognizes that guidance (OSWER Directive No.9285.7-25, July 1997, *Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments*) does not specifically require that a BERA be performed at every site, the guidance recommends that a BERA generally be performed at sites where the remedy is primarily designed to address ecological risk. The Board recommends that the Region either conduct a BERA in support of the remedy or provide an explanation in the decision documents as to why it did not believe carrying out a full BERA was appropriate for the evaluation of alternatives and selection of the remedy.

Response: *In accordance with the Board's recommendation, a Step 3a BERA has been completed which includes a refinement of the initial contaminants of concern identified in all media, as well as a revision of the food web exposure models to better characterize receptor exposures. This Step 3A evaluation utilized the results of the Screening Level Ecological Risk Assessment (SLERA) by introducing site-specific information such as the actual species observed or known to feed at the site and the likely portion of their diet from the site, to replace the generic assumptions used in the SLERA. This additional evaluation resulted in a significant change to the remediation goal for lead. By using site-specific information and conducting the analysis required by the Step 3A BERA, a more realistic and site-specific remediation goal of 400 milligrams per kilogram (mg/kg) for lead will be used to protect the ecological community.*

It was not clear through the presentation to the Board how each of the PRGs (preliminary remediation goals) were determined (human health, ecologically based risk or both) and whether

the proposed cleanup levels were based on human health risk reduction, ecological risk reduction, both human and ecological risk reduction, or driven by State regulations. Similarly, it was unclear in the presentation how the individual contaminant risks and associated PRGs fit into the Region's rational for use of a unified PRG approach for both soils and sediments. Given the complexity of issues involved (human and ecological risk, State regulations and soil-sediment relationships), the Board also recommends that the Region clarify in the decision documents which site-related contaminants and associated risks (human and ecological) are being addressed by the various, specific aspects of the Region's preferred remedy. The Board believes this clarification should help demonstrate how the Region's remedy selection approach ensures protection of human health and the environment, and complies with State applicable or relevant and appropriate requirements (ARARs).

Response: *Although the Board package included PRGs for arsenic and lead, the Region re-evaluated site conditions in response to Board comments and now is proposing only a PRG for lead. The PRG is protective of both human and ecological receptors and is consistent with State regulations for soils; it should be noted that no State ARARs are available for sediments. The unified PRG approach was developed in response to concerns that separate medium-specific PRGs for soil and sediment would not be protective in this environment, and that the natural tidal flushing and commingling of soils and sediments would result in cross-contamination if separate remediation goals were implemented. A detailed discussion of how the media-specific soil and sediment PRGs were developed, as well as how the unified PRG was identified, will be included in the decision document and is provided in the Region's response to Recommendation No. 7*

In the presentation to the Board, the Region indicated that, as part of the human health risk assessment, the fish/shellfish arsenic sampling was analyzed for total arsenic and was assumed to be inorganic arsenic. The Board notes that this is a conservative assumption, since the tissue samples were not analyzed for both inorganic and organic arsenic. The Board also notes that at other sites, arsenic speciation in fish tissue has significantly affected the risk conclusions. Since arsenic risk may drive at least a portion of the remedial action and exposure to arsenic via fish consumption appears to be a significant portion of the total arsenic exposure, the Board recommends that the Region explain in its decision documents the assumptions made regarding arsenic speciation within the risk assessment, and how those assumptions affected the evaluation of alternatives and selection of remedial action.

Response: *In response to this comment, the Region performed a qualitative re-evaluation of arsenic in biota tissue. Since only ingestion of fish and hard clam tissue posed an unacceptable health risk in the human health risk assessment, only these species were reassessed. The greatest risk posed to humans consuming biota at the Raritan Bay Slag site was through adult consumption of fish and hard clam (2×10^{-4} for both). The Region performed a literature search to estimate a typical range in biota tissue. The majority of the scientific literature indicates that inorganic arsenic in finfish and shellfish is generally less than 10 percent, sometimes much*

lower. Arsenic is generally less than 10 percent but can range up to nearly 30 percent in contaminated areas. The Region re-evaluated the data using the most conservative literature value of 30 percent inorganic arsenic to qualitatively evaluate arsenic in fish and hard clam at the site. The maximum arsenic concentration in fish was 0.68 mg/kg, below the health-protective screening level of 1.4 mg/kg. The maximum arsenic concentration in hard clam was 1.6 mg/kg, below the health-protective screening level of 2.8 mg/kg. As a result, the Region has concluded that arsenic in fish or hard clams does not pose an unacceptable human health risk.

3. Remedial Action Objectives

The package provided to the Board states that there were two rounds of groundwater sampling, with the second round done to confirm lead results from the first round. The Board is concerned that this sampling approach results in insufficient data on which to base a final groundwater remedial action. The package also states that the RAO (remedial action objective) for groundwater is to "reduce to acceptable levels the human health risks from the ingestion of groundwater," yet there are no associated PRGs/cleanup levels against which to measure this reduction. The preferred alternative calls for ICs to restrict use of groundwater and long-term monitoring. The Board notes that under the NCP, the remedy selection process under CERCLA is guided by several expectations (see 40 CFR § 300.430(a)(1)(iii)), which include: 1) groundwater should be returned to its beneficial use wherever practicable in a reasonable time frame, and 2) ICs should supplement engineering controls to prevent or limit exposure, but ICs normally "shall not substitute for active response measures" (i.e., ICs are not to be used as the sole remedy unless active response measures are determined to be impracticable). Furthermore, the Agency's long-standing policy (OSWER Directive No. 9355.3-01, October 1988, *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERLCA,* Chapter 4) is that monitoring by itself is not a CERCLA remedial action; the Board is concerned that the information submitted to the Board suggests that monitoring to evaluate effectiveness of the source control remedy may be intended to constitute a final groundwater response action for this site. As such, the Board recommends that the decision documents more clearly explain the role of monitoring in the Region's preferred approach and provide a clear, measurable RAO and associated cleanup level. The Board also suggests that, should one be needed, the Region consider issuing a separate future final groundwater remedial action decision document.

Response: *Since the Region presented the site to the Board, the New Jersey Department of Environmental Protection (NJDEP) has agreed that a Class III-B designation for groundwater in the area containing monitoring wells MW-07S-R1, MW08D-R1, MW-08S-R1, MW-09S-R1, MW-10D-R1, MW-10S-R1, and MW-12S-R1 applies. As a result of this reclassification, drinking water wells cannot be installed, and associated ARARs no longer apply to groundwater in the affected area. Groundwater is not currently used as a drinking water source at the site. Future potable use of groundwater in the Class III-B designated area is prohibited and, therefore, an RAO for groundwater is no longer necessary.*

The package provided to the Board states: "Adult anglers and children consuming self-caught fish and hard clam from the site have cancer risks or noncancer health hazards exceeding EPA's target threshold due to arsenic." In light of this statement, the Board recommends that the Region establish a specific RAO for this exposure route and develop measurable cleanup levels (concentration limits) for arsenic in specific fish and clams so it is clear when the RAO will be achieved.

Response: *Please refer to the Regional response to Recommendation No. 2 of this document. The Region does not believe that arsenic in fish or hard clams poses an unacceptable human health risk. Consequently, no additional biota sampling will be conducted.*

4. Remedy Performance

Based on the package presented to the Board, Alternative 5 would include a sediment cap in Area 8, but it is unclear if the intended purpose of the proposed cap would be as an "active" cap for sequestering lead (such as a reactive core mat design containing apatite) or as an inert sand cap for physical isolation purposes. In light of the CERCLA and NCP preference for remedial actions that utilize treatment technologies to the maximum extent practicable, the Board recommends that the Region explain in its decision documents why it did not further consider a sediment cap (either active or inert). In addition, the Board notes that there are a limited number of *in-situ* treatment technologies (such as soil amendment, solidification/stabilization or mechanical size separation) that could be considered for lead-contaminated soil/sediment in the non-jetty areas of the site. The Board recommends that the Region better explain in its decision documents why these technologies are not practicable to the maximum extent at this site.

Response: *The sediment cap proposed under Alternative 4 (formerly, Alternative 5 in the package presented to the Board) does consist of a reactive core mat, so it is indeed an "active" cap. Although such a sediment cap is feasible in areas which are constantly under water, the feasibility is uncertain in intertidal areas. Since significant portions of Area 8 are beach areas, the potential exists for exposed portions of the cap to be tampered with by beachgoers if the cap extends to intertidal areas. Further, the durability of the cap is uncertain when subjected to the environment which could compromise its effectiveness. Also, since the proposed cap will be in close proximity to the western jetty, it is unclear who will be responsible for the maintenance, replenishment or replacement of the cap. It should be noted that the New York District of the Army Corps of Engineers is responsible for maintenance activities involving the navigable portions of the western jetty. In correspondence to the Region, the Corps has expressed a non-preference for any remedy that requires monitoring and maintenance of caps in contaminated areas.*

In-situ stabilization/solidification of these areas was considered; however, they were screened out for a variety of reasons that impact the long-term effectiveness and implementability of the technologies at the site. As noted previously, a significant portion of the site consists of beach

areas that are subject to erosion. Solidification technologies were screened out because solidified materials are not suitable for placement on beach areas. Stabilization, unless complete mixing of the stabilization agent and the contaminated materials is achieved, may result in exposures of beachgoers to unacceptable risks. Achieving such complete mixing in the environment at the site is not believed to be practical; thus, stabilization was also screened out.

Mechanical size separation technology was not considered because the contamination exists in both the fine fraction as well as the coarse fraction, as indicated in the fractionation results during the characterization study of the slag and contaminated sediment.

Therefore, the Region believes that the only appropriate remedies for these areas are limited capping in specific areas and dredging.

Based on the package provided to the Board, an MNR (monitored natural recovery) approach is included as a component of the remedial alternatives. For example, the preferred alternative, as presented in the package, appears to rely on MNR for the wetlands area (including possibly some portions that may be wetland/hydric soil areas). The Board recommends that the Region more clearly explain its proposed use of MNR for the wetland area (e.g., in the hatched area of Figure 38 in the package) and include lines of evidence in the administrative record that support its use. The Board also recommends that the decision documents more clearly explain how the MNR component of the preferred alternative would ensure protectiveness.

Response: *Please refer to the Regional response to Recommendation No. 2 of this document. MNR had previously been identified as a component of the remedial alternatives to address sediments associated with arsenic. As explained above, the Region has eliminated arsenic as a human health risk driver, and consequently, the MNR approach to address the sediments in the jetty sector and the "wetland areas" of Margaret's Creek Sector is no longer applicable.*

5. Applicable or Relevant and Appropriate Requirements

The Region's presentation to the Board included definitions for wetland soil versus aquatic sediment that were developed for the Raritan Bay site. The Board believes that the definitions for wetland soil and aquatic sediment are critical components for the preferred alternative (No. 3) which includes excavations, MNR and on-site disposal. The Board recommends that the Region clarify the site-specific soil and sediment definitions and explain their compatibility with other EPA definitions (e.g., http://water.epa.gov/type/wetlands/types_index.cfm) and other agencies' definitions (e.g., Army Corps of Engineers [COE]Wetlands Delineation Manual and Soil Conservation Service's [SCS] definition for hydric soils), as well as the relationship to MNR, and the State of New Jersey's soil standards.

The Board notes that for certain areas of the site, the Region may be considering the New Jersey soil remediation standards as a potential ARAR. At the same time, it appears that the Region's

preferred alternative would consider the wetlands area as a contaminated sediment site and would use an MNR approach for cleanup. Application of the definitions of wetland soil and aquatic sediment could be important for evaluating alternatives and determining the potential use of ARARs and TBCs (to be considered guidance) at this site. In particular, the Board recommends that the Region describe in more detail how various portions of the site are saturated, flooded or ponded, as described in the EPA/COE/ SCS definitions. In light of existing Agency definitions developed for the wetlands program, the Board recommends that the Region more clearly explain in its decision documents how it is delineating specific areas of soil and sediment throughout the site, and whether the State soil standards should be considered more appropriately as potential ARARs or TBCs in various locations.

Response: *The term "sediment" in the Jetty Sector, Seawall Sector and bay areas of Margaret's Creek Sector refers to all contaminated solids other than slag and battery casings/associated wastes seaward of the mean high tide line. This definition is similar to the definition of sediments used in the ecological risk assessment, which is one of the key drivers in establishing the need for remediation and the PRGs. In all other areas of Margaret's Creek Sector, the term "sediments" refers to solids that are submerged in water, and the term "soils" refers to solids other than the slag and battery casings/associated wastes that are on dry land. The demarcation line of the area "submerged in water" and "dry land" was delineated based primarily on the National Wetlands Inventory (NWI) mapping and was evaluated during the development of the FS and also discussed with all stakeholders. The definition of sediment is consistent with EPA's "Contaminated Sediment Remediation Guidance for Hazardous Waste Sites" and the areas designated as wetlands are consistent with the Corps "Wetlands Delineation Manual."*

There are no specific ARARs for sediment. ARARs for soil are clearly described in Section 2.2 of the FS.

Furthermore, the package presented to the Board indicates in Table 9 that Executive Order 11988 and OSHA 29 CFR 1910 are applicable standards. The Board notes that, while these are important considerations, they do not represent the kind of promulgated, enforceable and generally applicable (or waiveable) regulations or standards that generally qualify as ARARs. The Region should clarify the list of ARARs consistent with Appendix E of OSWER Directive No. 9355.3-01, October 1988, *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLCA* and contact OSRTI/ARD/SARDB if it needs assistance.

Response: *In response to the Board's comment, the Region has reviewed the list of ARARs to ensure that it includes the correct regulations and standards. As a result of this review, the Region has changed the following:*

- *In Table 10, Executive Order 11988 from "Applicable" to "To Be Considered"*
- *In Table 10, Wetland Executive Order 11990 from "Applicable" to "To Be Considered"*
- *In Table 11, removed OSHA 29 CFR 1910 from the table.*

Finally, in the presentation to the Board, the Region indicated that the final arsenic cleanup level of 15 mg/kg was derived from the site-specific background concentration of arsenic. The Region's justification for using background as the remedial goal was founded in a human health risk characterization that utilized conservative assumptions of arsenic chemical form and toxicity. These conservative assumptions, coupled with State regulations and EPA policy, support the use of background as the cleanup goal when risk-based remedial goals are below background. Given that further evaluation of arsenic risk at this site may suggest that human health arsenic risk is lower than the risks presented, the Board notes that the risk-based sediment arsenic remedy goal may increase to a concentration above background. Since it was unclear in the presentation to the Board whether the State actually has a numeric arsenic standard for sediment that constitutes an ARAR, the Board recommends that the Region better explain in its decision documents whether the State standard for arsenic is an ARAR or TBC, and how this could affect the remedy.

Response: *Please refer to the Regional response to Recommendation No. 2 of this document. The Region has eliminated arsenic as a human health risk driver. As a result, the risk-based PRG for arsenic in sediment has been eliminated and is no longer applicable.*

6. COST

According to the information presented to the Board, the discount rate used for the net present worth cost calculations of remedial alternatives was 5.25 percent. However, the Board notes that, in accordance with current EPA guidance, OSWER Directive 9355.0-75 (July 2000; pages 4-4 and 4-5), a discount rate of 7 percent should generally be used for all non-Federal facility feasibility study present-value analysis. Therefore, the Board recommends that the Region either: (1) use a discount rate of 7 percent for all present worth calculations, or (2) provide an explanation and sensitivity analysis in accordance with the above-noted 2000 EPA guidance. In addition, it is noted in the cost information presented to the Board that an escalation factor of 3.11 percent was also used in the present value cost analysis for all remedial alternatives. The Board recommends that the Region provide further explanation in the decision documents for the use of this escalation factor. Finally, in the cost summary information presented to the Board (page 39 of the package), it appears that non-discounted operation and maintenance costs were used in the calculation of what is referred to as "present worth costs." While the OSWER guidance referenced above recommends the development of a non-discounted scenario (page 4-2), it also states that the non-discounted scenario should be presented for comparison purposes only, and should not be used in place of present value costs in the remedy selection process. The Board recommends that the Region review the present worth analysis for each of the alternatives to ensure that the appropriate values were used in the development of total present worth costs. Future decision documents should include present worth values calculated using 7 percent and may include present worth values using a different discount rate provided a specific explanation is given.

Response: *In response to the Board's comment, the Region has reviewed the cost information presented in the FS to ensure that all costs were estimated consistent with national guidance. Types of costs that are assessed for each alternative include the following:*

- *Capital costs*
- *Annual operation and maintenance (O&M) costs*
- *Periodic costs*
- *Present value of capital and annual O&M costs*

Cost estimates are developed according to "A Guide to Developing and Documenting Cost Estimates during the Feasibility Study (EPA, 2000a)." Flexibility is incorporated into each alternative for the location of remedial facilities, the selection of cleanup levels, and the period during which the remedial action will be completed. Assumptions of the project scope and duration are defined for each alternative to provide cost estimates for the various remedial alternatives. Important assumptions specific to each alternative are summarized in the description of the alternative. Additional assumptions are included in the detailed cost estimate of the FS in Appendix D.

The levels of detail employed in making these estimates are conceptual but are considered appropriate for making choices between alternatives. The information provided in the cost estimates is based on the best available information regarding the anticipated scope of the remedial alternatives.

The use of discount rates for present value cost analyses is stated in the preamble to the NCP (55 FR 8722) and in OSWER Directive 9355.3-20 (Revisions to Office of Management and Budget [OMB] Circular A-94 on Guidelines and Discount Rates for Benefit-Cost Analysis, 1993). As outlined in A Guide to Developing and Documenting Cost Estimates during the Feasibility Study (EPA, 2000a), a 7 percent real discount rate should be applied over the period of evaluation for each alternative. The real discount rate is defined as:

Real discount rate = [(1+nominal discount rate)/(1+inflation rate)] – 1

The 20-year nominal treasury interest rates (OMB, 2010) for the last 6 years (no data is available prior to 2004 for the 20-year interest rate) have generally been less than 6 percent, and inflation over the same period has averaged around 3 percent per year. Thus, the 7 percent real discount rate is not believed to be realistic for alternative evaluation cost estimating. An inflation rate of 3.2 percent (average of 20 years of Engineering News Record [ENR] Construction Cost Indices rounded to the nearest tenth of a percent) and a nominal discount (interest) rate of 5.25 percent (average of the available data for nominal 20-year treasury interest rates rounded to the nearest quarter of a percent) was applied separately in the determination of net present value.

The above rationale for using a different rate notwithstanding, the Region will include present worth costs based on a 7 percent interest rate in future decision documents for comparison purposes.

In the package and presentation to the Board, it was noted that Remedial Alternatives 3 - 6 all meet, to varying degrees, the NCP comparative analysis of alternatives criteria. It was also noted that the preferred alternative (No. 3) was approximately $30M (million) more than Alternative 4 or 5; this additional expense results from the Region's preference to excavate/dredge and dispose off-site all of the contaminated slag, battery casings, and soil and sediment (excluding areas 7, 9, and 11). Further, the Region indicated that the contaminated slag and battery casings mainly constitute the site's principal threat waste (PTW). The Board commends the Region for PTW removal and disposal-treatment at this site; however, it is unclear why the remaining, lesser-contaminated soil and sediment cannot be adequately contained on-site at a lower overall cost while still ensuring protectiveness of human health, consistent with the NCP's nine criteria for evaluating alternatives. Given this lack of clarity, the Board recommends that the Region more clearly explain in the decision documents its reasons for preferring a more costly remedy over other alternatives that are also protective at this site.

Response: *Based on the additional analysis of arsenic in fish and hard clam which concluded that arsenic is no longer a risk driver, all of the remedial alternatives (except Alternative 1, No Action) were revised to eliminate the MNR component identified in Alternatives 2 - 6. (Please refer to the Regional response to Recommendation No. 2 of this document.) In addition, Alternative 3 was eliminated since it became identical to Alternative 2.*

The Region understands the Board's concern regarding the selection of Alternative 2 (formerly, Alternative 3) as compared to Alternative 3 or 4, especially as the NCP criteria are met for all these alternatives (Alternatives 2 - 5). The decision by the Region to recommend Alternative 2 as the preferred alternative is based on the following:

- *The preferred alternative permanently addresses all Principal Threat Waste, and soil and sediment above the PRG in a manner consistent with Agency PTW guidance, ("A Guide to Principal Threat and Low Level Threat Wastes," Publication # 9380.3-06FS, EPA, 1991) .*
- *The level of O&M is much reduced compared to Alternatives 3, 4 and 5 which require maintenance of the on-site containment cell for an indefinite period.*
- *The uncertainty of approval from the Borough and community for the placement of an on-site containment cell.*
- *The initial acceptance from the community and the State supporting the goal to remove most of the contamination from the site.*
- *The Corps advocating the removal of source and contaminated material from areas under its jurisdiction.*

- *The proposed locations of the on-site containment cells immediately adjacent to residential neighborhoods and in close proximity to community recreational areas. As the leaching tests conducted as part of the Remedial Investigation indicate, the slag and battery casings have exhibited the potential for leaching.*

7. Preliminary Remediation Goals

During the presentation to the Board, the Region indicated that as a result of some recent re-analysis, the unified lead PRG may be established as 400 mg/kg rather than the value of 232 mg/kg, the value presented in the review package. The Board also notes that comments provided on behalf of NL Industries. Inc. by Advanced Geoservices Corporation, dated March 12, 2012, raised issues with regard to both the proposed PRGs and the use of the unified PRG approach at this site. The Board recommends that the Region, in its decision documents, better explain the basis for the selection of each of the compound-specific PRGs and its rationale for the use of the unified PRG approach.

The Board notes that the package states that long term-monitoring would include biota sampling; the Board recommends that the Region's decision documents include cleanup levels against which sampling results will be compared.

Response: *As noted in response to Recommendation No. 2, more realistic exposures were considered during the Step 3a BERA, which focuses on refining the contaminants of concern (COCs) list and using more appropriate parameters in the calculation of ecological risk. All bioaccumulative compounds were retained in the calculations, regardless of whether they were identified as COCs based upon comparison to media screening values. As part of these exposure calculations, the conceptual site model was reviewed, along with the measurement and assessment endpoints. Information regarding bioavailability of contaminants was available, as fish, mollusk, and plant tissue data were collected by EPA's Environmental Response Team. These tissue values were used in the calculation of risk. However, one of the uncertainties associated with the calculations is the assumption that the form of the chemical present in the environment is absorbed with the same efficiency as the chemical form used in laboratory bioaccumulation and toxicity studies. In addition, a limited number of species have been tested for bioavailability. Further refinement based upon specific absorption rates of contaminants was not available; thus, the assumption was made that any contaminant ingested had 100 percent absorption. While conservative, using a value of less than 100 percent would add additional uncertainty to the risk calculation. During refinement of the food web model calculations, it was noted that certain organisms used as assessment endpoints will not be present year round (e.g. Semipalmated plover) and, therefore, exposures were calculated based on a seasonal use factor to better represent the time that the organism is expected to be at the site. Per the ecological risk assessment guidance, during the screening level exposure estimate, the assumption is that the home range of an organism is entirely within the contaminated area. However, during the BERA, this value may be modified to better characterize the exposure.*

The site-specific human health and ecological risk assessments indicate that lead poses a risk to human health. A PRG was derived for lead based on comparison to ARARs, risk-based levels (human health and ecological), and background concentrations using a two-step process:

- *During the first step, the lowest of the three sets of values (ARARs, human health and ecological risk-based values) was selected.*
- *During the second step, the selected result from the first step was compared to the background concentration. The higher of the two values was selected as the PRG.*

The process began with developing a PRG based on parameters specific to each media – i.e., soil and sediment. In the second step, the soil PRG and sediment PRG were compared and a single PRG (the unified PRG) was proposed which aimed to collectively address the entire site as a whole regardless of environmental media (e.g., soil or sediment). The reason that a single PRG was proposed for the site is because in this coastal environment along Raritan Bay and in the tidal zone areas, the chemical and physical characteristics of soil and sediment in many cases are indistinguishable. Additionally, due to the nature of the site (comingling/relationship between soil and sediment in the intertidal zone areas), there is a significant potential for re-contaminating soil or sediment if the two were cleaned up to different levels. Soil and sediment are interchangeable in some areas. Therefore, one PRG is provided for soil/sediment.

For lead, a unified PRG of 400 mg/kg was selected. This value represents the human health risk-based number which is also protective of aquatic ecological receptors based on site-specific data. The lowest value was the soil human health risk-based number. During the Remedial Investigation, site-specific background samples were collected to define the background metal concentrations for the site. Since the risk-based value for lead was higher than the site-specific background concentration, the risk-based value was selected. Additionally, the 400 mg/kg risk-based value for lead was identical to the NJDEP soil remediation standard for lead.

In closing, I again want to thank the Board for its very comprehensive review of the information presented by the Region involving the remediation of the source areas, soils and sediments at the Raritan Bay Slag site. The Board's valuable input will help ensure that the remedy is selected, designed and constructed in a cost-effective manner.

As always, please do not hesitate to contact me with any questions.

cc: Walter Mudgan
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